combustion-chambers are to be taken as illustrations of two or more chambers, as becomes desirable in practice. When two chambers are employed, the charge may be compressed into the whole compression-space or one-half of it. If three chambers be employed, the regulation is more close and the charge may be compressed into one-third of the space, two-thirds of the space, or the whole of it. As shown in Fig. 1, both of the combustion-chambers are in use, the valves F′ F^2 being off their seats, the remaining valves all closed. At this point the charge is exploded by a spark caused by the igniter L, which is placed in the lowermost combustion-chamber. This explosion drives the piston downward and compresses into the crank-chamber the air below it. As the piston reaches the lower end of the stroke and starts on its expulsion-stroke the cam acting on the lever G^4 opens the exhaust-valve F^4 and the charge is expelled through the exhaust-passage e^2. Just as the piston reaches the extreme upper movement on the expulsion-stroke the cam acting on the lever G′ forces the valve F′ tightly against its seat and holds it there throughout the admission-stroke. During this admission-stroke the the valve F is opened, exhaust-valve F^4 remains open, and the scavenging-vave F^3 is opened by its lever G^3, the result being that air compressed in the crank-chamber by the downwardly-moving piston rushes through the pipe N and through the bonnet f^7 and through the combustion-chambers and out through the exhaust-valve, thoroughly cleaning the combustion-chambers. The next stroke of the cycle is the compression-stroke. On this stroke the valves F, F^3, and F^4 are all closed, and the valve F′ is away from its seat, and the valve F^2 may be away from its seat, as shown in Fig. 1, the charge being thus compressed into the two compression-chambers, or this valve F^2 may be on its seat, restricting the compression to the chamber d^3. A suitable check-valve M, opening into the crank-chamber, allows the admission of air thereinto on the upward stroke of the piston. To provide for the corresponding control of the admission and combustion chamber valves, I have the following mechanism: Mounted above the hood D is a rock-shaft P, which is under control of the operator by suitable means, as illustrated, by the rock-lever p, mounted on said shaft. Extending upward from the shaft is a rock-arm p', to which is connected a bar p^2, which extends beneath a yoke Q, in which the bearing q' of the cam-lever G is slidably mounted. The bar p^2 is inclined on its under face, and a spring q^3 presses the bearing q' upward against said bar. Now if the lever p is pulled in the direction to force the bar p^2 into the yoke Q, the bearing q' is forced downward, wherefore the lever G when acted on by its cam forces farther downward the stem f^8 of the valve F, opening that valve wider, thus increasing the amount of charge admitted. Loosely journaled on the rock-shaft P is a pawl p^3. A pin p^4 extends from the rock-shaft through a slot p^5 in the hub of this pawl. This results in allowing independent movement of the pawl and rock-shaft to the extent of the space provided by the slot p^5, but compels the two to rotate in unison with any further movement of the rock-shaft. Now during the first positions of the lever p—that is, those at the right of the positions shown in Fig. 3—the incline of the bar p^2 is depressing but slightly the bearing q' and the cam-lever G opens the admission-valve for something less than one-half the full admission. In these first positions of the lever p the pin p^4 is against the forward wall of the slot p^5 and holds the pawl p^3 out of action. The spring around the shank of the valve F^2 is thus enabled to hold this valve against its seat, shutting off the upper combustion-chamber and restricting the compression to the lower chamber d^3. When the lever p is moved into its positions for greater speed, (being those at the left of that shown in Fig. 3,) the wedge-bar p^2 forces down the bearing q' sufficiently so that the admission-valve is opened much wider by the cam-lever. This also swings the pin p^4 away from the end of the slot p^5 and allows the nose p^7 on the upper end of the pawl to spring over the head of the stem of the valve F^2. As soon as this valve is depressed, as it is always during the scavening operation, the spring p^3 insures the pawl assuming this position when the position of the rock-lever allows it.

It will be understood from the above description that the amount of charge may be regulated to a nicety by the lever p' or its equivalent and that as the charge increases at a certain point the size of the combustion-chamber is increased. In the embodiment shown this point is at half-charge, anything less than half-charge using only the lower chamber d^3 and anything more than half-charge using both chambers. The arm G′, which operates the combustion-chamber valve, is itself a rather stiff leaf-spring, resulting in the valve F′ being snugly seated when the cam closes it.

I claim—

1. The combination with an explosive-engine including a cylinder and a separable stationary combustion-chamber, of means for forcing a scavenging charge of air through the same at a time when the combustion-chamber is not in communication with the cylinder.

2. In a four-cycle explosive-engine, in combination, a cylinder, a separable stationary combustion-chamber, and exhaust-passage for the cylinder leading from said combustion-chamber, and means for forcing a scav-